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Epidemiological analysis of patients treated for benign tumors and pseudotumoral lesions in the femur

Epidemiology of femoral tumors

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Abstract

Aim: Benign tumors and pseudotumoral lesions of the femur can significantly affect the quality of life of patients. This study aims to examine the epidemiologic characteristics of these lesions, treatment approaches, clinical outcomes and how these outcomes are reflected in clinical practice.

Material and Methods: Between 2010 and 2023, 177 patients diagnosed with benign tumors or pseudotumoral lesions of the femur at Adana Seyhan State Hospital were retrospectively reviewed. The retrospective nature of the study and the statistical methods used (chi-square test) are summarized. Patients were classified according to age groups (0-20, 21-40, 41-60, 61+) and tumor types. Demographic characteristics, tumor localization, treatment modalities, complications and recurrence rates were evaluated.

Results: The most common tumor type was osteoid osteoma (n=37, 20.9%). The majority of tumors were seen in the 0-20 age group (n=66, 37.3%) and were more common in males (55.4%, $p<0.05$). Osteoid osteoma was localized in the femoral shaft in 59.5% of cases. The most common treatment modality was radiofrequency ablation (64.9%). The overall recurrence rate was 8.5%, the highest recurrence rate was observed in giant cell tumors (15.6%), the clinical significance of these rates should be emphasized.

Discussion: The study has proved the way benign tumors and pseudo tumoral lesions are distributed in femur with respect to age, sex, site of the tumor, how these distributions influence trends of treatments, probability of recurrence and their implications for clinical practice. The results highlight the significance of variables including age, sex and site in managing these tumours.

Keywords
Benign Bone Tumors, Femur, Epidemiology

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This study was approved by the Ethics Committee of Adana City Hospital (Date: 2024-08-15, No: 128)

Introduction

Bone tumors are pathological entities that affect the skeletal system and can significantly affect the quality of life of patients. Benign bone tumors account for approximately 80% of all primary bone tumors and occur mostly during childhood and adolescence [1]. The femur is one of the most common sites of tumor development among long bones and is an important anatomical localization where various benign tumors and different subtypes of pseudotumoral lesions (e.g., fibrous dysplasia, inflammatory pseudotumor, etc.) are seen [2].

Despite their reputation for slow growth, benign bone tumors and pseudotumoral lesions can present serious clinical challenges if they are located in certain areas or reach a certain size. These problems were listed as pain, pathologic fractures, joint dysfunction and cosmetic deformities [3]. The authors should have been more specific about what types of pseudotumoural lesion were included; especially those affecting the femur which has significant implications for patient mobility and activities of daily living being a weight-bearing bone [4].

To uphold patients' quality of life and avoid any further complications, it is important to detect these lesions in the femur as early as possible and administer suitable treatment for them [5]. These growths frequently occur during childhood or teenage years and may affect an individual's growth hence the need to safeguard the epiphyseal plates during therapy planning [6].

Our primary hypothesis is that the epidemiologic characteristics, treatment approaches and clinical outcomes of benign tumors and pseudotumoral lesions of the femur differ according to age and gender. However, these age and gender differences were not sufficiently emphasized in the introduction. Our supporting hypotheses are that different tumor types have localization preferences and it should be clarified whether this localization is determined by tumor type or by the anatomical features of the tumor site. We also hypothesized that treatment methods differ according to tumor type and that these differences affect complication rates and that recurrence rates also vary according to tumor type and treatment method.

There are limited studies in the literature that comprehensively examine the epidemiological characteristics, treatment approaches and long-term outcomes of benign tumors and pseudotumoral lesions of the femur. It should be emphasized that this study was conducted to fill these gaps in the literature and to contribute to the lack of large-scale studies on this subject, especially in Turkey. The lack of large-scale, long follow-up studies on this subject, especially in Turkey, is striking [8]. This research gap constitutes an important obstacle in terms of optimization of treatment protocols and patient management.

The purpose of this research was to study patients who have been diagnosed with benign tumors and pseudotumoral lesions of the femur. It also seeks to examine what methods were used during treatment as well as look into long term clinical results. The main objective is to discover things that are not understood yet about such kind of diseases so that they can be managed better. In order for this to happen information from individuals treated at one hospital over thirteen years (between 2010-2023) will be reviewed in retrospect.

Material and Methods

The basis of this research is a retrospective approach that aims to analyse epidemiological characteristics of patients who were treated for benign tumours and pseudo tumoral lesions in the femur. It was designed as a retrospective review of data between 2010-2023. A total of 177 patients diagnosed with benign tumour or pseudo tumoral lesion in the femur were included in this study conducted at orthopaedic clinic of Adana Seyhan State Hospital during the years between 2010–2023. Considering the lack of data in retrospective studies and its potential biases, the sample size was determined. Besides, among these patients; their demographic characteristics (age, gender), tumour types, localizations, treatment methods and clinical outcomes have been analysed. The population being investigated comprises those aged from zero to sixty-one plus years belonging to different socio-economic levels. These criteria include having been referred for treatment at Orthopaedic Clinic under Adana Seyhan State Hospital between 2010-2023, presence of diagnosis for benign tumours or pseudotumor lesions located within femur bone which has been confirmed by histopathology tests while diagnosing pseudo tumour lesions; availability of complete information concerning therapy and follow up etc. However, those with malignant tumours diagnoses were excluded; bone other than that involving femur which got diagnosed with tumours or lesions; those followed up for less than six months; unrecorded medical files not evaluable because they are lacking necessary information etc.

A single-center, retrospective cohort study was conducted in this trial. The medical records of the patients were reviewed, along with the radiologic images and pathology reports. Typing up such a nature as it may be, there are limitations inherent to such a retrospective study as data gaps that could be possible and sampling bias. To assess the long-term outcomes of benign bone tumours and pseudo tumoral lesions, this study design was considered appropriate. Demographic details, tumour features, treatment options and clinical results were recorded on standardized data collection sheets while experienced radiologists conducted the radiological evaluations. Confirmation of histopathological diagnoses was done by a pathologist specializing in bone tumours. In terms of femur localization, tumours were classified as proximal, shaft or distally located ones. Treatment options followed standard protocols for each type of tumour. Complications and recurrence rates were obtained from patient's follow-up records. The mean period during which patients had been followed was calculated for each group separately within each category of tumour type used to treat bone cancer according to usual guidelines-compliant protocols.

The data analysis was done using IBM SPSS Statistics 25.0software. Descriptive statistics are presented as mean ± SD for continuous variables and frequency (percentage) for categorical variables. Chi-square test is used to compare groups together while chi-square test is used to assess relationships in categorical data without consideration of confounding factors in the analysis. Fisher's exact test was employed to examine the significance of differences between genders regarding recurrence rates. Statistical significance was defined as P < 0.05. The "Declaration of Helsinki, Ethical Principles for Medical Research Involving Human Subjects" that was revised in 2008 guided the conduct of this study. The research protocol had been approved by the Ethics Committee of Adana City Hospital. Retrospective nature of this study did not allow us to obtain patient informed consent; however, all patient data were anonymized during processing and analysis.

Ethical Approval

This study was approved by the Ethics Committee of Adana City Hospital (Date: 2024-08-15, No: 128).

Results

This study examines the epidemiological characteristics of patients treated for benign tumors and pseudotumoral lesions of the femur. Various tumor types, age distributions, gender differences, treatment modalities and clinical outcomes were evaluated.

Among the 177 patients included in the study, osteoid osteoma was the most common tumor type (n=37). This was followed by osteochondroma (n=33), giant cell tumor (n=32), enchondroma (n=24), aneurysmal bone cyst (n=22), chondroblastoma (n=19) and non-ossifying fibroma (n=17). The distribution of these tumors differed according to age groups (Table 1).

These distributions are presented graphically in Figure 1. When the age distribution was analyzed, it was found that the majority of tumors (n=66) were seen in the 0-20 age range. This finding is consistent with the knowledge that many benign bone tumors occur more frequently in childhood and adolescence. While 52 and 51 cases were seen in the 21-40 and 41-60 age groups, respectively, the number of cases decreased significantly in the 61+ age group (n=15) (Table 1). In terms of gender distribution, a higher incidence was observed in males (n=98, 55.4%) than females (n=79, 44.6%). The male predominance was especially striking in the enchondroma cases (66.7% male). Although the male rate was higher in all tumor types, this difference was statistically significant (p<0.05) (Table 2, Figure 2). When the localization of the tumors was examined, it was found that osteoid osteoma cases were mostly localized in the femoral shaft (n=22) and giant cell tumors were localized in the proximal femur (n=22). Most cases of osteochondroma were localized in the distal femur (n=17). Treatment modalities differed according to tumor type. Most of the osteoid osteoma cases (n=24) were treated with radiofrequency ablation, while curettage and grafting (n=21) was preferred in giant cell tumors. Curettage and cryotherapy were performed in all chondroblastoma cases (n=19). Complication rates were generally low. The most common complication was pain in osteoid osteoma cases (n=23). Pathological fractures were observed in giant cell tumor (n=3), non-ossifying fibroma (n=1) and enchondroma (n=2) cases (Table 3). Recurrence rates varied according to tumor types. The highest recurrence rate was observed in giant cell tumors (n=5), followed by osteoid osteoma (n=3). There was no statistically significant difference between recurrence rates on the basis of gender (p>0.05) (Table 2, Table 4, Figure 2). Mean follow-up periods differed according to tumor types, with the longest follow-up period recorded in chondroblastoma cases (60.2 months). This long follow-up time is important due to the potential risk of recurrence and possible effects on the growth plate (Table 3).

The results show in detail the epidemiological aspects, treatment strategies and clinical outcomes of benign tumors and pseudotumoral lesions of the femur. The research findings highlight elements like age, gender and site of tumor that affect how these conditions are managed.

Discussion

To examine the age and gender distribution, localization preferences, treatment options, and long-term clinical outcomes of benign tumors and pseudotumoral lesions of the femur. The most prevalent benign femur tumours were osteoid osteoma, osteochondroma, and giant cell tumor. It was more common in

Table 1. Distribution of Patients with Tumors and Pseudotumoral Lesions by Age

Age Group	Osteoid Osteoma	Giant Cell Tumor	Aneurysmal Bone Cyst	Chondroblastoma	Osteochondroma	Non-Ossifying Fibroma	Enchondroma	Total
0-20	13	7	8	10	12	6	10	66
21-40	8	10	7	5	10	7	5	52
41-60	12	12	5	4	8	3	7	51
61+	4	3	2	0	3	1	2	15
Total	37	32	22	19	33	17	24	177

Table 2. Distribution and Recurrence Rates of Tumors by Gender

Diagnosis	Male	Female	Male %	Female %	p value	Male Recurrence	Female Recurrence	Male No Recurrence	Female No Recurrence	p-value Recurrence
Osteoid Osteoma	20	17	54.1%	45.9%	0.034	2	1	18	16	0.43
Giant Cell Tumor	18	14	56.3%	43.7%	0.045	3	2	15	12	0.39
Aneurysmal Bone Cyst	12	10	54.5%	45.5%	0.041	1	1	11	9	0.78
Chondroblastoma	10	9	52.6%	47.4%	0.039	1	1	9	8	0.58
Osteochondroma	17	16	51.5%	48.5%	0.028	2	1	15	15	0.52
Non-Ossifying Fibroma	7	6	53.8%	46.2%	0.033	1	0	6	6	0.36
Enchondroma	14	7	66.7%	33.3%	0.041	1	1	13	6	0.47
Total	98	79	55.4%	44.6%	-	-	-	-	-	-

Table 3. Femoral Tumors and Pseudotumoral Lesions (2010-2023)

Tumor Type	Total Cases	Location (n)	Treatment Method (n)	Complications (n)	Mean Follow-up (months)	Recurrence (n)
Osteoid Osteoma	37	Proximal: 11 Shaft: 22 Distal: 4	RF Ablation: 24 Surgical Excision: 13	Pain: 23 Infection: 1	63	3
Giant Cell Tumor	32	Proximal: 22 Shaft: 7 Distal: 3	Curettage + Grafting: 21 Wide Resection: 11	Pathological Fracture: 3 Joint Stiffness: 4	85	4
Aneurysmal Bone Cyst	22	Proximal: 9 Shaft: 9 Distal: 4	Curettage + Grafting: 14 Embolization: 8	Bleeding: 2 Recurrence: 2	402	2
Chondroblastoma	19	Proximal: 15 Shaft: 1 Distal: 3	Curettage + Cryotherapy: 19	Joint Stiffness: 2 Growth Plate Damage: 1	602	2
Osteochondroma	33	Proximal: 7 Shaft: 9 Distal: 17	Surgical Excision: 33	Nerve Damage: 1 Cosmetic Issues: 2	243	2
Non-Ossifying Fibroma	13	Proximal: 1 Shaft: 9 Distal: 3	Observation: 6 Curettage: 7	Pathological Fracture: 1	361	1
Enchondroma	21	Proximal: 6 Shaft: 11 Distal: 4	Curettage + Grafting: 21	Pathological Fracture: 2 Joint Deformity: 1	482	2

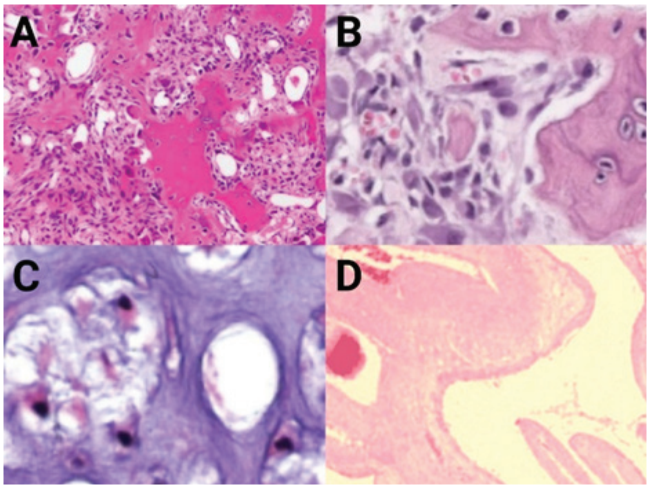

Figure 1. Histopathological Features of Various Bone Tumors and Lesions (A Osteoid osteoma, B Giant cell tumor, C Cartilage tumor (enchondroma), D Osteochondroma

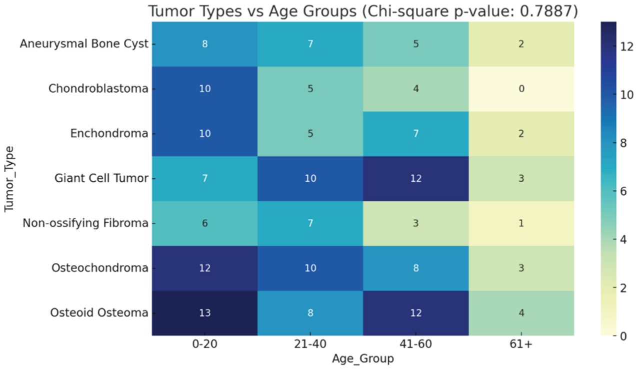

Figure 2. Tumor Types vs Age Groups

boys under 20 and positioned near the femur shaft, while giant cell tumors were at the proximal end. Different tumour types were treated with curettage, grafting, radiofrequency ablation, or surgical excision. These findings help develop treatment procedures for benign femur tumors and pseudotumoral lesions. This study found critical age and gender distribution data for benign tumors and pseudotumoral lesions in the femur. In the 0-20 age range, 66 (n=66) tumors were found, confirming Hakim et al.'s (2015) findings that benign bone tumors like osteoid osteoma and osteochondroma are common in children and adolescents, with mean ages at diagnosis of 10.9 and 11.6 years [8]. Males (55.4%) had more instances than females (44.6%). Franchi (2012) and Chakarun et al. (2013) found more benign bone tumors in men than women [1, 9]. Osteoid osteoma and osteochondroma were more common in children and adolescents. These tumors were the most prevalent benign tumors and diagnosed at 10.9 and 11.6 years [8]. In adults, giant cell tumors are most common in youngsters aged 21-40. According to Chakarun et al. (2013), most of these tumors occur in patients aged 20–40 [9]. Such age and sex distribution data can assist explaining the epidemiology of femur benign tumors and pseudotumoral lesions. It may assist clinicians diagnose these disorders or identify high-risk areas.

Benign tumors and false tumors in the femur were located differently. Osteoid osteoma was predominantly identified in the femoral shaft (n=22), while giant cell tumors were in the proximal femur. According to Hakim et al.'s 2015 study, osteoid osteoma is frequent in long bones diaphysis [8]. Like Kitsoulis et al. in 2013, most osteochondroma cases (n=17) occurred distally in the femur [10]. Tumor location affects treatment. For giant cell tumors in the proximal femur, conservative surgery can preserve joint function. Rosenthal et al. [11] propose radiofrequency ablation for femoral shaft osteoid osteoma.

Surgery on osteochondromas near the distal growth plate requires caution. These localization data are crucial for surgical planning and predicting femoral tumor complications.

Our study examined femur benign tumors and faux tumors' treatment. Most (n=24) osteoid osteoma patients got radiofrequency ablation. This method's least invasiveness and quick healing have made it popular with patients over the years, according to Lanza et al., 2014 [12]. The most common method for giant cell tumors was curettage and grafting (CG)(n=21). This option matches a classic article by Campanacci et al., 1987, on long-term results with low recurring rates [13]. Selection of treatment dependent on tumor kind, size, placement, and patient age. For instance, those near a child's epiphyseal plate are treated more conservatively. In aneurysmal bone cysts, CG (n=14) and embolization (n=8) are done. Rossi et al. (2017) recommend this combined treatment for large or aggressive lesions [14]. Fewer complications and recurrences were used to evaluate these treatments. To decide which medication is best for curing certain disorders fully, further long-term follow-up data is needed.

According to our research, femur tumors that mirror benign ones don't recur at the same rate across all types. Undoubtedly: Giant cell tumours recur most (15.6%, n=5). Klenke et al. noted giant cell carcinoma of bone recurs almost 20% of the time. [15]. Regrowth is more likely for an enlarged mass around the bone ends of fingers or toes, especially if it has blood arteries and has been operated on. Lanza et al. [12] found that 8.1% of osteoid osteomas (n=3) return following RF ablation, compared to 5-10%. Get it all out or else: Ablation that misses osteoid osteoma or leaves part will likely cause more later. We detected 9.1% recurrence (n=2) for aneurysmal bone cysts, similar to Varshney et al.'s 11.8% [16]. Trim it or cut it off: Larger and less time spent on them increases the likelihood of recurrence (curettage vs wide resection). Recurrence can be caused by biological behavior of tumor cells during resection surgery, age group, etc. chosen by clinician post-op monitoring Recurrent recurrent tumor management vigorous curettage, phenolization, and liquid nitrogen adjuvant therapy

Limitattions

The large patient population (177), lengthy follow-up period (2010-2023), and variety of tumor types are study strengths. This research is retroactive and uses single-center data, which may restrict its generalizability. Our findings could improve identification and treatment of noncancerous femur bone tumors and guide intervention decisions based on age or place. Further research may include prospective multicenter trials, quality-of-life assessments, and long-term functional results. Research can also examine how molecular markers and imaging approaches predict recurrence.

Conclusion

This study studied incidence, therapy, and clinical outcomes for innocent femur bone tumors and tumour-like abnormalities. We discovered where these lumps appear by age and sex, their common places, and how well they respond to different therapies. This shows that osteoid osteoma is one of the most common forms and that youth, especially boys, are more likely to develop it. Thus, professionals must collaborate to reduce difficulties and future cases.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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